



First record of *Thamnodynastes almae* Franco & Ferreira, 2002 (Serpentes, Dipsadidae, Xenodontinae) in the state of Piauí, northeastern Brazil, and updated distribution map

Diogo B. e S. Barbosa^{1,2}, Mauro S. C. S. Lima², Thaís B. Guedes^{3,4}

1 Programa de Pós-Graduação em Zoologia, Universidade Federal do Pará and Museu Paraense Emílio Goeldi, Belém, PA, 66077-830, Brazil. **2** Universidade Federal do Piauí, Campus Amílcar Ferreira Sobral, BR 343 km 3,5, Meladão, 64805-608, Floriano, PI, Brazil. **3** Programa de Pós-Graduação em Biodiversidade, Ambiente e Saúde, Universidade Estadual do Maranhão, Caxias, MA, 65064-380, Brazil. **4** Gothenburg Global Biodiversity Center, University of Gothenburg, Department of Biological and Environmental Sciences, Box 461, SE-405 30, Göteborg, Sweden.
Corresponding author: Thaís B. Guedes, thaisbguedes@yahoo.com.br

Abstract

We report for the first time the snake *Thamnodynastes almae* Franco & Ferreira, 2002 in Piauí, northeastern Brazil. Our record is based on two specimens and comprises the 17th known locality for the species. The new record represents the northernmost and westernmost locality, at the limit between the Caatinga and the Maranhão Babaçu Forest ecoregions, and extends this species' geographic distribution 495 km from Milagres, state of Ceará. Updated distribution maps and images of preserved specimens are provided.

Keywords

Caatinga, Maranhão Babaçu Forest, range extension, South America, Tachymenini.

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Introduction

The tribe Tachymenini Bailey, 1966 is a monophyletic group that contains seven genera of Neotropical dipsadid snakes: *Calamodontophis* Amaral, 1967; *Gomesophis* Hoge & Mertens, 1959; *Pseudotomodon* Leybold, 1873; *Ptychophis* Gomes, 1925; *Tachymenis* Wiegmann, 1835; *Thamnodynastes* Wagler, 1830, and *Tomodon* Duméril & Bribon, 1853 (Vidal et al. 2010; Grazziotin et al. 2012). The monophyly of the tribe is supported by both morphological and molecular evidence (Ferrarezzi 1994; Vidal et al. 2010; Grazziotin et al. 2012). Approximately 35 species are distributed in cis-Andean South America (Franco et al. 2003; Bailey et al. 2005, 2017; Guedes 2010; Guedes et al. 2014a, 2018).

The genus *Thamnodynastes* is the most speciose of the tribe, with 20 species distributed from 11.0166°S, 074.6833°W in Colombia to 037.4810°S, 057.5290°W in Argentina (Guedes et al. 2018; Rojas-Morales et al. 2020). Brazil harbors the greatest diversity of the genus, with 12 species (Costa and Bérnils 2018). The genus contains species of medium size, with two enlarged grooved rear teeth, vertical pupils, a single nasal scale, and two anterior temporal scales in most species, dorsal scales in odd number of rows showing reduction in the number towards the tail, dorsal scales smooth in most species, vertebral row of the same size as neighboring scales, apical pits present, anal plate divided, distinct color pattern

composed of a blotched dorsal pattern variegated or striped posteriorly, ventral region presenting two to six longitudinal lines, and a dark postocular stripe (Peters and Orejas-Miranda 1970; Franco et al. 2017). The taxonomy of the genus is intricate, with the validity of some taxa still unsolved (e.g., *Thamnodynastes* cf. *nattereri*), and possibly with several species undescribed, despite the recent description of new species (e.g. *Thamnodynastes phoenix* Franco, Trevine, Montingelli & Zaher, 2017) (Franco and Ferreira 2002; Franco et al. 2003, 2017; Bailey et al. 2005; Bailey and Thomas 2007; Rojas-Morales et al. 2020).

Thamnodynastes almae Franco & Ferreira, 2002 was described based on three specimens, all from the Luiz Gonzaga Hydroelectric Plant, Rodelas, Bahia, northeastern Brazil. The occurrence of the species in Milagres, Ceará, Brazil, outside the type locality, was reported seven years later (Roberto et al. 2009). Guedes (2010) reported the occurrence of the species in five localities of four states. Currently, the species is known to occur in 16 localities in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, and Rio Grande do Norte (Roberto et al. 2009; Guedes 2010; Coelho et al. 2013; Guedes et al. 2014a, 2018; Freitas et al. 2019). Based on its known distribution, *T. almae* is considered endemic to the Caatinga, mostly associated with low elevation areas (below 400 m above the sea level) with xerophytic vegetation, rocky soils, and inselbergs (Guedes et al. 2014a; Dinerstein et al. 2017).

Here, we provide an updated database of the distributional records of *T. almae* and provide the northernmost and westernmost record of the species in Brazil, the first in the state of Piauí, at the border between Caatinga and Maranhão Babaçu Forest ecoregions. We also present an updated map of the species' distribution.

Methods

We examined specimens of the genus *Thamnodynastes* housed in the Coleção de História Natural da Universidade Federal do Piauí (CHNUFPI), Campus Amílcar Ferreira Sobral, Floriano, Piauí, Brazil. We carefully examined the specimens based on the following external morphological characters: body and head color pattern; measurements of the body, head and tail; meristic characters (Franco and Ferreira 2002; Franco et al. 2003, 2017; Bailey et al. 2005; Bailey and Thomas 2007). We measured the snout vent length (SVL), tail length (TL), and total length (TotL) using a measuring tape; the relative TL was obtained by dividing TL by TotL. Scale counts followed Dowling (1951). We determined the sex with a ventral incision at the base of the tail.

We reviewed the scientific literature for occurrence records of the species in South America (Table 1). Updated distribution maps were drawn using QGIS v. 2.14 (QGIS Development Team 2018).

Results

Thamnodynastes almae Franco & Ferreira, 2002

Figures 1, 2

New record. BRAZIL • 1 ♂ adult, 412 mm SVL, 100 mm TL, 5.12 TotL/TL; state of Piauí, municipality of José de Freitas, Nazareth Ecoresort; 04.7993°S, 042.6136°W, 159 m a.s.l.; July 2007; Vitor Hugo Gomes Lacerda Cavalcante leg. (field number ERN032) [CHNUFPI(SER) 0116]. • 1 ♀ adult, 433 mm SVL, 121 mm TL, 4.57 TL/CL; same locality data, collection date, and collector as above (field number ERN049) [CHNUFPI(SER) 0117].

Identification. We identified both specimens [CHNUFPI(SER) 0116, 117; Fig. 2] following Franco and Fer-

Table 1. Literature and herpetological collection data of occurrences of *Thamnodynastes almae* in Brazil. Acronyms: Coleção Herpetológica da Universidade Federal do Rio Grande do Norte (CHBEZ), Instituto Butantan (IBSP), Coleção de Herpetologia do Museu de Fauna da Caatinga (MFCH), Museu de Zoologia da Universidade Federal da Bahia (MZUFBA), Museu de Zoologia da Universidade de São Paulo (MZUSP), Coleção Herpetológica da Universidade Federal da Paraíba (CHUFPB).

State	Locality	Latitude (°S)	Longitude (°W)	Voucher	Reference
Piauí	Nazareth Eco Resort, municipality of José de Freitas	04.7993	042.6136	CHNUFPI(SER)0116, 0117	This study
Alagoas	Hydroelectric Plant Xingó, municipality of Piranhas	09.6167	037.7833	MZUFBA 847	Guedes 2010
Bahia	Hydroelectric Plant Luiz Gonzaga, municipality of Rodelas	09.1000	038.3333	IBSP 52134-52136	Franco and Ferreira 2002
Bahia	Hydroelectric Plant Itaparica, municipality of Paulo Afonso	09.4000	038.2000	MZUFBA 131-38	Guedes 2010
Bahia	Municipality of Itiúba	10.7297	039.8454	MZUSP 5433-34	Guedes 2010
Ceará	Municipality of Milagres	07.2781	038.9363	IBSP 76969	Roberto et al. 2009
Ceará	Mocambo Farm, municipality of Picuí	06.5052	036.3368	CHUFC 1672	Guedes et al. 2014
Paraíba	Bravo Farm, municipality of Cabaceiras	07.2755	036.2214	UFPB 4263	Guedes 2010
Paraíba	Municipality of São José de Piranhas	07.1100	038.4900	MFCH 1870	Coelho et al. 2013
Pernambuco	Municipality of Petrolândia	08.8980	038.3043	IBSP 52119	Guedes 2010
Pernambuco	Municipality of Cabrobó	08.5000	039.3100	MFCH 1847, 1862	Coelho et al. 2013
Pernambuco	Municipality of Salgueiro	08.0700	039.1200	MFCH 1867	Coelho et al. 2013
Pernambuco	Municipality of Floresta	08.5900	038.5700	MFCH 1849-52, 1855-61, 1865,1868-69	Coelho et al. 2013
Pernambuco	Municipality of Custódia	08.0800	037.6400	MFCH 1848, 1863-64	Coelho et al. 2013
Pernambuco	Municipality of Sertânia	08.0756	037.2693	MFCH 1853-54, 1866	Coelho et al. 2013; Freitas et al. 2019
Pernambuco	Municipality of Arcoverde	08.4184	037.0585	not informed	Freitas et al. 2019
Rio Grande do Norte	Tanques Farm, municipality of Santa Maria	05.8540	035.7010	CHBEZ 3044-3046	Jorge and Freire, 2011

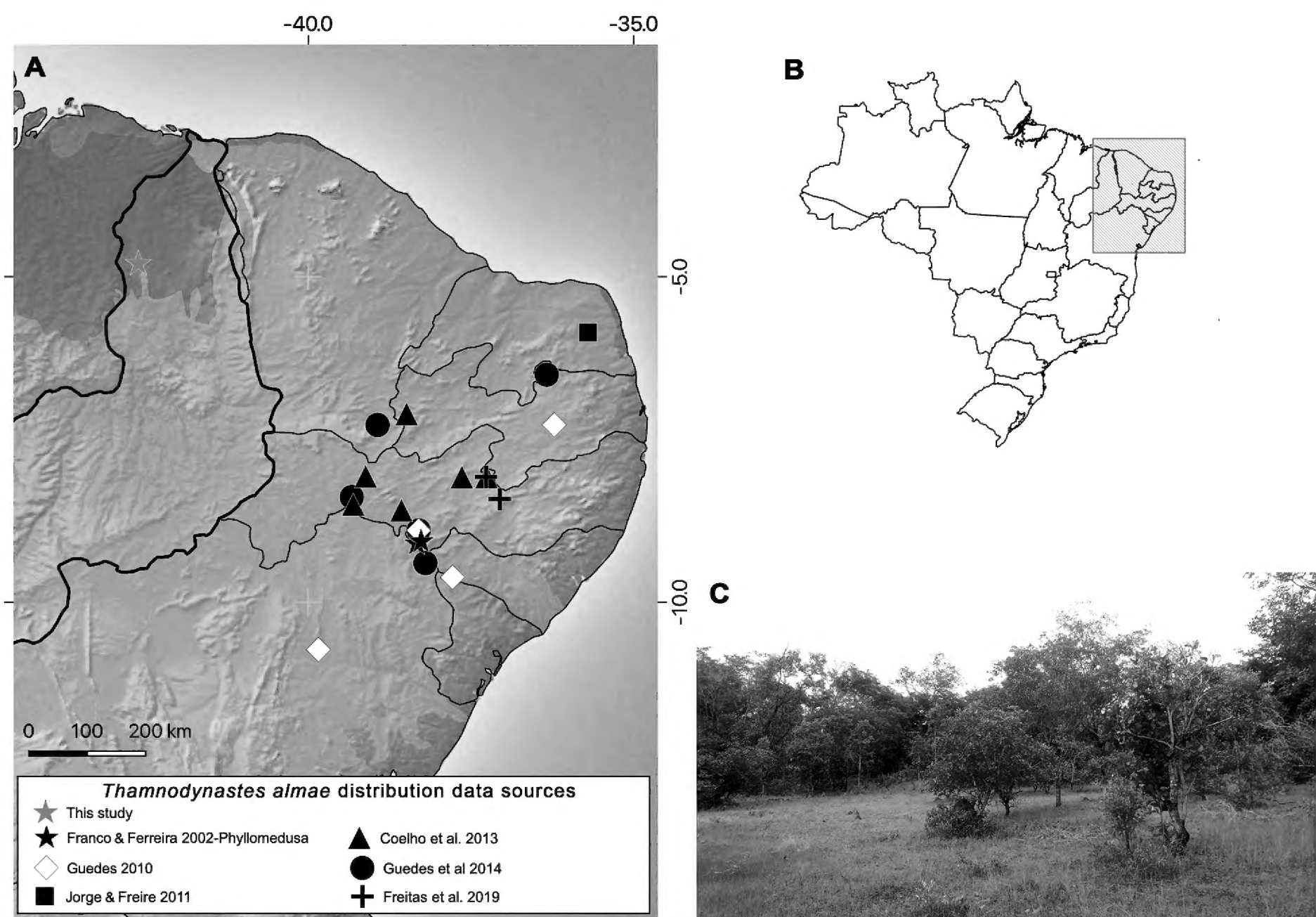


Figure 1. **A.** Distribution of *Thamnodynastes almae* based on literature records, including the new record. White Diamond: Guedes 2010; Black square: Jorge & Freire 2011; Black Triangle: Coelho et al. 2013; Black circles: Guedes et al. 2014; Black cross: Freitas et al. 2019; Black star: Franco and Ferreira 2002 (type locality); Red star: new record in the Nazareth Ecoresort, Municipality of José de Freitas, state of Piauí, Brazil. Ecoregions classified according to Dinerstein et al. 2017 (available at <https://ecoregions2017.appspot.com>): light green area shows the boundaries of the Caatinga, brown shows the limits of the Maranhão Babaçu Forest. **B.** Northeastern region of Brazil where *T. almae* occurs. **C.** Vegetation type where *T. almae* was recorded.

reira (2002), based on the following diagnostic characters: dorsal scales heavily keeled in 19-19-15 rows; 159 ventral scales in the male and 158 in the female; 67+1 paired subcaudals in the male and 65+1 in female; cloacal scale divided; eight supralabials on both sides of the head with the 3rd to 5th supralabials contacting the orbit; nine infralabials on both sides, 1st to 5th contacting the first pair of chin shields, 5th contacting the second pair of chin shields, temporals 2+2, one preocular and two postoculars on both sides of the head, loreal plate higher than long, maxillary tooth with trace of a groove (opisthoglyphous). In 70% ethanol, the dorsal background color is light yellowish brown, the gular region is immaculate light, and the ventral region is light with a homogeneous longitudinal line that does not darken towards the cloaca. Our photographs, and pholidosis of the specimen, were also verified by Francisco L. Franco, who confirmed the identification.

Discussion

The two specimens examined here represent the 17th known locality for *T. almae* and the first record of the species from the state of Piauí (Table 1). Both specimens were collected at the transition between the Maranhão Babaçu Forest and the Caatinga ecoregions (Dinerstein

et al. 2017; Fig. 1A, B). Specimens were collected in the Eco Resort Nazareth, which is covered with semideciduous forest, patches of Cerrado *sensu stricto*, and palm grove (Fig. 1C). This record is the northernmost and westernmost one for the species, extending its distribution 495 km from Milagres, state of Ceará (Roberto et al. 2009). Our new record also extends the estimated extent of occurrence from 90,775 km² (Guedes et al. 2014a) to 2,225,890 km².

Despite the valuable attempts to provide data about the herpetofauna of Piauí (e.g., Rocha and Prudente 2010; Rodrigues and Prudente 2011; Silva et al. 2015; Madella-Auricchio et al. 2017; Araújo et al. 2020), systematic and long-term inventories are still needed to provide data on snake fauna. The state of Piauí can potentially harbor a high richness of snakes (and other organisms) because it spans five ecoregions (Caatinga, Cerrado, Maranhão Babaçu Forests, Northeastern Brazil Restingas, and Brazilian Atlantic Dry Forests; Dinerstein et al. 2017), which promote a mosaic of vegetation types. Additionally, the topography varies from sea level at the coast to approximately 822 m a.s.l. near the border with Ceará (Parque Nacional de Ubajara) and also at the borders with Bahia, Tocantins, and Maranhão (Nascentes do Rio Parnaíba National Park), which could harbor

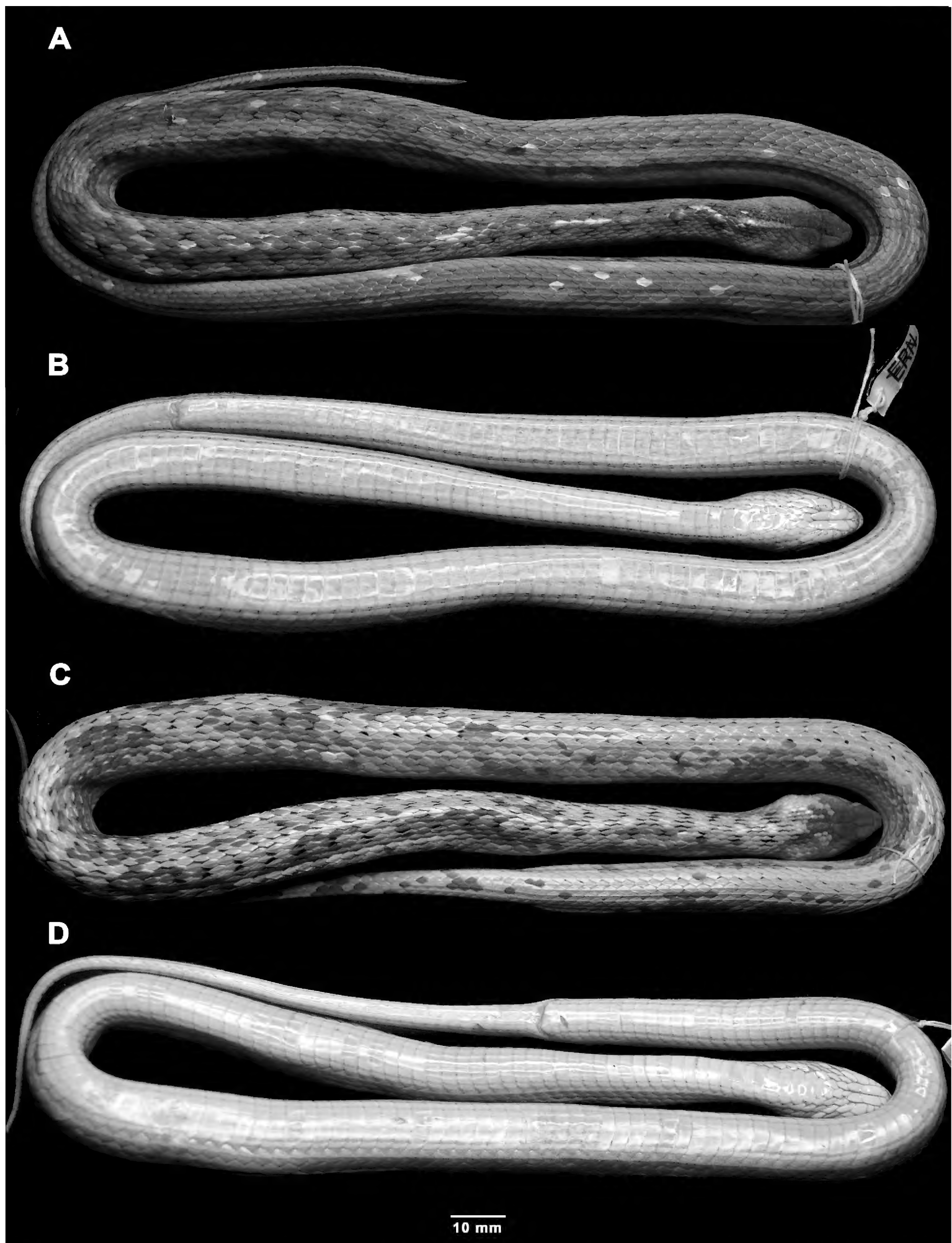


Figure 2. Specimens of *Thamnodynastes almae* recorded in the Nazareth Ecoresort, Municipality of José de Freitas, state of Piauí, Brazil. **A, B.** Adult male CHNUFPI(SER) 0116: **(A)** dorsal view; **(B)** ventral view. **C, D.** Adult female CHNUFPI(SER) 0117: **(C)** dorsal view; **(D)** ventral view.

lowland and highland species. Sixty species of snakes are known to occur in Piauí, which is few compared to nearby states, and is the result of the relatively less sampling effort in the state (Guedes et al. 2018: fig. 2A, B).

Two snakes species were associated with the genus *Thamnodynastes* in the inventories and taxonomic studies in Piauí: *T. hypoconia* (Cope, 1860), which was reported in Parnaíba and Piracuruca (Guedes et al. 2014a),

and *T. phoenix*, reported from Castelo do Piauí, Canto do Burití, Estação Ecológica Uruçuí-Una, Piracuruca, São Raimundo Nonato, and Valença do Piauí (Franco et al. 2017). *Thamnodynastes* sp. was also reported in the same municipalities mentioned above (Rocha and Prudente 2010; Rodrigues and Prudente 2011; Madella-Auricchio et al. 2017). This unidentified species might represent additional specimens of *T. hypoconia*, *T. phoenix*, or even *T. almae*. *Thamnodynastes sertanejo* Bailey, Thomas & Da Silva, 2005 might also occur in Piauí if extensive inventories were undertaken in the area; *T. sertanejo* occur in bush vegetation in semi-arid lowlands, which are typical of the Caatinga, and occur in the municipality of Exú, state of Pernambuco, only 91 km from the border of Piauí (Guedes et al. 2014a). *Thamnodynastes hypoconia* presents a horseshoe-shaped mark in the gular region (Franco and Ferreira 2002). *Thamnodynastes phoenix* has the gular region extremely spotted with dark-brown dots, and infralabials and chin shields with a white center (Franco et al. 2017), while *T. almae* presents the gular region that is almost immaculate, with just a few scattered, small, brownish spots or blotches present; in *T. almae* the dorsal scales are heavily keeled (Franco and Ferreira 2002).

Taxonomy and conservation are different fields: the first is interested in describing biodiversity and the second in protecting it (Ely et al. 2020). However, to apply legal instruments to guide conservation decisions we must first identify the species and know their geographical distribution to be able to design effective protected areas. Thus, one important target of the Convention on Biological Diversity (CBD 2020) is to fill the Wallacean shortfall by gathering and sharing distribution data. This paper provides a newly reports a species of snake from the state of Piauí and also improves our knowledge of the distribution of an endemic species of the Caatinga, which is an ecoregion largely neglected in terms of its conservation (Guedes et al. 2014b).

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Authors' Contributions

DBSB performed the literature review for occurrence data and wrote the first draft; MSCSL assisted DBSB

with the literature review and contributed writing the first draft; TBG identified the specimens, performed pholidosis, measurements, photographed the specimens, prepared figures, revised the draft, and prepared the first version of the manuscript; all authors revised the manuscript.

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